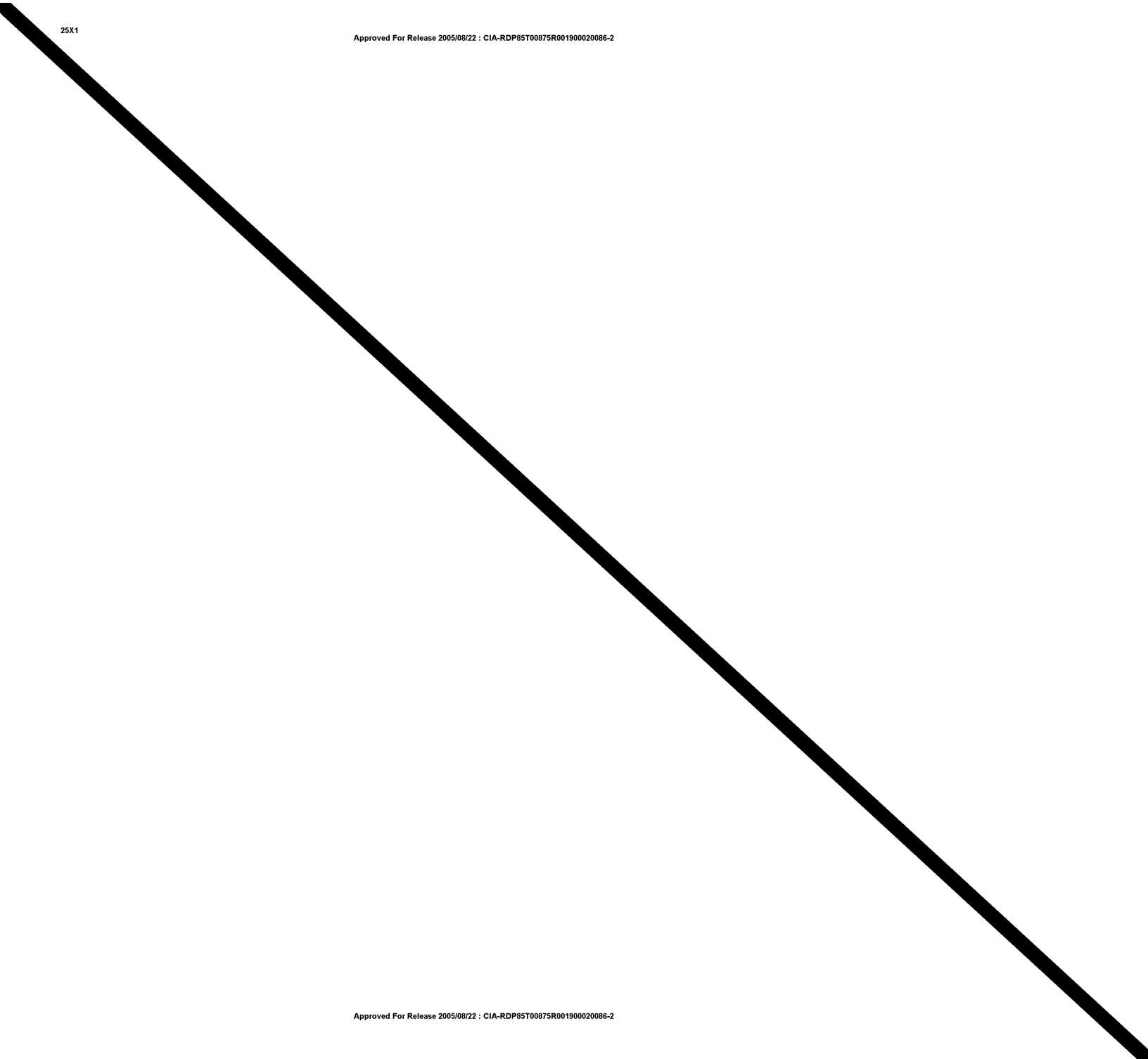

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[redacted]

22 March 1974

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MEMORANDUM FOR: Mr. Rauer H. Meyer
Director
Office of Export Administration
Bureau of International Commerce
Department of Commerce

SUBJECT : Progress in the Production of Semiconductors in the USSR and Eastern Europe

REFERENCE : USSR and Eastern Europe: Semiconductors, dated 9 Apr 73

1. Attached, is an up-date of an earlier discussion of semiconductor state-of-the-art in the USSR and Eastern Europe (see Reference). [redacted]

2. Any queries concerning the attached study or requests for additional information, may be addressed directly to [redacted]

Attachment:
as stated

[redacted]

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Distribution: (S-6004)
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ATTACHMENT

Progress in the Production of Semiconductors in the USSR and Eastern Europe

Trends

It is now apparent that the semiconductor industries in the USSR and Eastern Europe are shifting rapidly to silicon technology and away from germanium, although product mix is probably still weighted heavily in favor of germanium devices. Increasingly, these countries are seeking to purchase Western-made equipment and technology. Poland, which already has acquired a complete IC production capability from France, soon will have the most modern IC industry in Eastern Europe. All of the other East European countries apparently are bent on following Poland's lead and would like to modernize their industries with Western technology. Meanwhile, these countries are working hard to improve their own technology. A significant effort to develop an indigenous MOS capability on the basis of ion-implantation is underway in Hungary. The development of ion-implantation techniques in Hungary is said to be more advanced than in the USSR. However, there is still no evidence that Hungary can produce MOS devices based on ion-implantation.

On balance, the Communist countries have not made any significant gains on the US technological lead in semiconductors. Production is expanding, but the average quality of devices remains suspect. Future progress in production of IC's is likely to be most marked in Poland which is in the process of completing the installation of French equipment and is now beginning to produce IC's in small quantities.

Production

Integrated Circuit Devices

It is estimated that the USSR, in 1972, produced 45 million monolithic integrated circuits (IC's); 2-3 million may have been produced in Eastern Europe (See Table 1). Most of the monolithics produced in the USSR and Eastern Europe are RTL, DTL and TTL devices of SSI complexity. In addition, the USSR produced an estimated 40 million hybrid IC's; 2-3 million may have been produced in Eastern Europe. Most of

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these are relatively simple circuits of the SLT type in use in the United States in the early 1960's. There is ample evidence that IC's (monolithic and hybrid) produced in the USSR and Eastern Europe are of poor quality, poor reliability, and poor performance. In the most recent example, [redacted] in order to produce one properly functioning third-generation RYAD (R-20) computer three machines in production must be cannibalized for components.

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The estimated output of IC's in the USSR was derived by summing up estimates of output in individual production facilities. Information on yield in individual production facilities is practically non-existent and it is almost impossible to estimate usable output. There are reasons for believing that usable output probably represents only a fraction of the given estimate: first, the total is very large relative to known civilian requirements. For example, it is estimated, at the outside, that no more than 8 million devices would have been needed in 1972 (10% of output) to meet all civilian requirements (mainly computers and some calculators). Second, the military requirement for IC's probably is not large since few systems are believed designed, at present, for IC's. For example, some military electronic systems of relatively recent manufacture that would be good candidates for IC's are known to contain transistors and even tubes.

The USSR has made progress during the past year in the development of ECL devices, CMOS IC's, and TTL/MSI. In addition, some gallium aluminum arsenide LEDs have been fabricated. There is no evidence that any of these devices is yet in full-scale production. [redacted]

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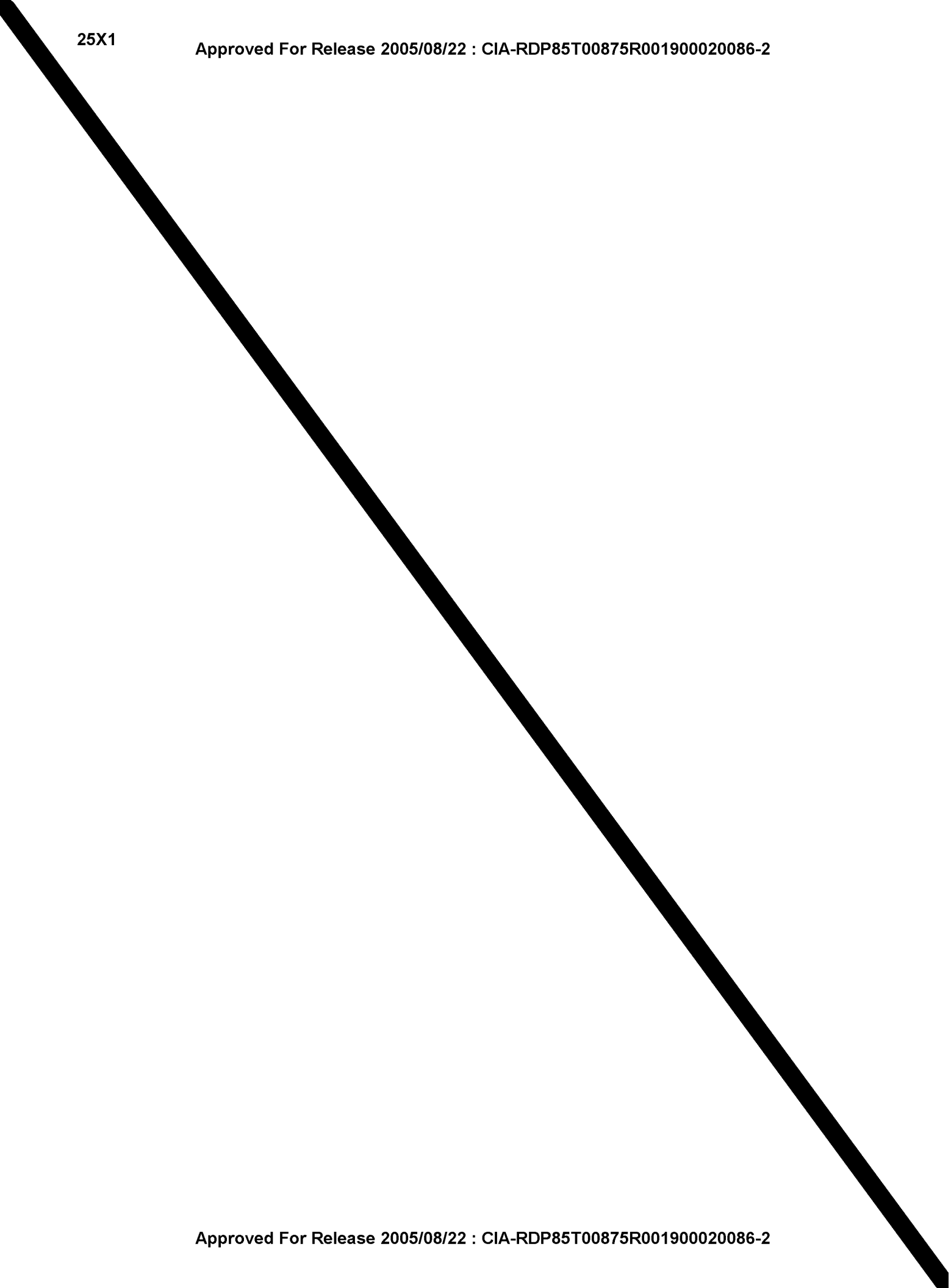

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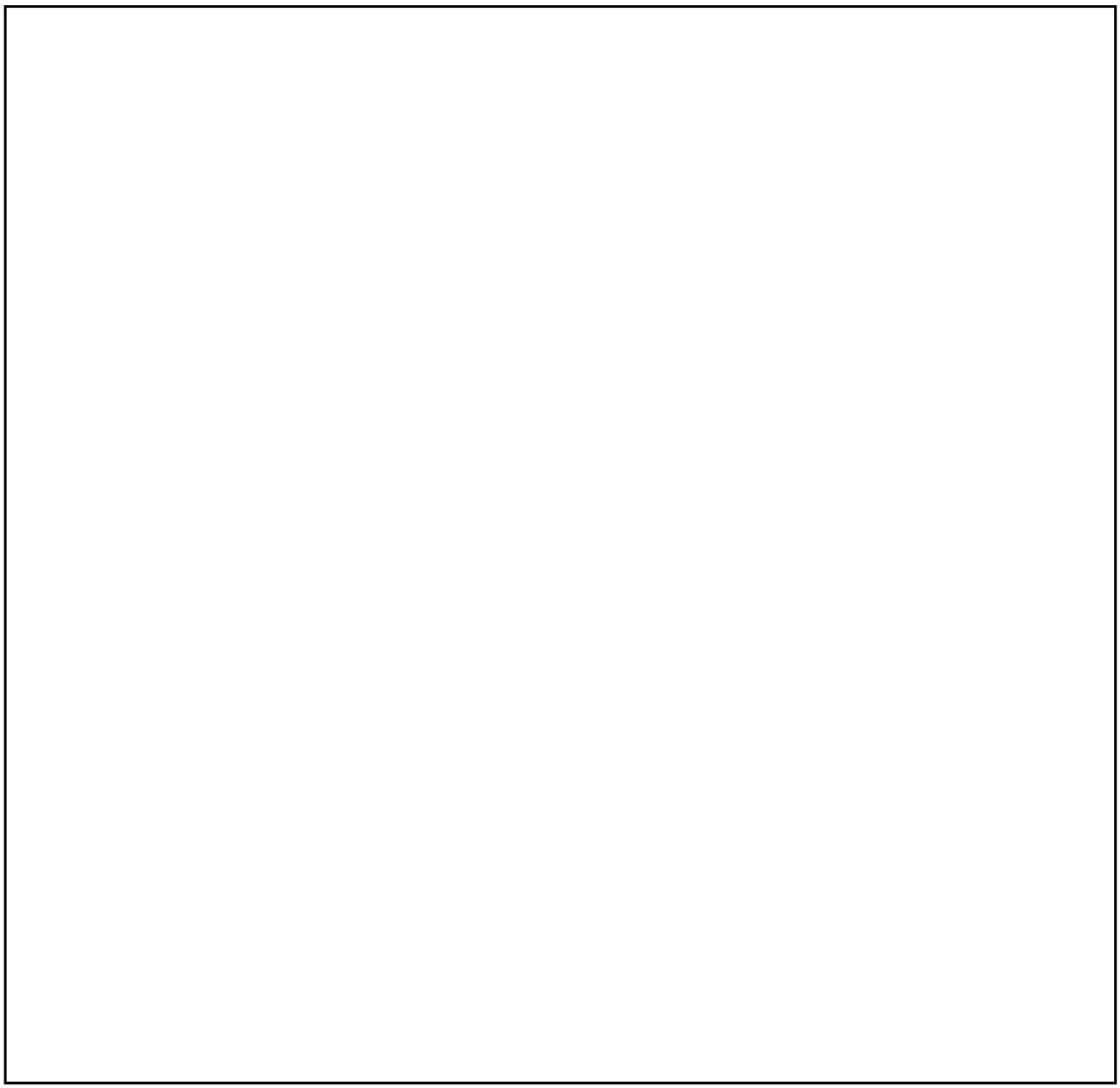

East Germany is the only other country in Eastern Europe that claims to be producing relatively advanced semiconductor production machinery. It is difficult to conclude from these claims, which appear in the technical literature or are implicit in the exhibit of a prototype, that these items are in

production or use. Doubts concerning actual availability are intensified by the fact that East Germany is attempting to purchase many of the items that they claim to be producing. Available (fragmentary) information indicates that East German semiconductor production equipment in use is not very good. For example, in one case, East German diffusion furnaces were operating so poorly that they were taken out of operation. In another case, it has been reported that East German mask-alignment equipment is a principle source of low yields in IC production. Finally, East Germany is known to be experiencing major difficulties in getting its own IC production underway which may reflect, at least in part, deficiencies in East German production equipment in use.

Integrated Circuit Testers

Some IC testers have been built by the USSR, East Germany, Hungary, Poland, and Czechoslovakia. As far as can be determined, they are relatively simple, manual, static, GO/NOGO machines that do not compare, technologically, with Western-made systems.

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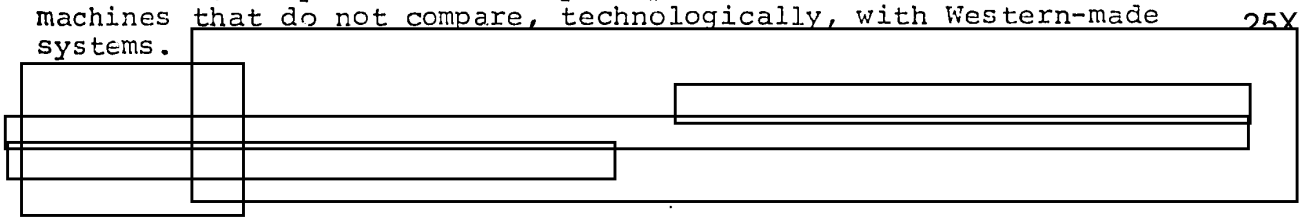

1. Native testers are copies of Western systems.

2. A large portion of the total Communist capability consists of illicitly acquired Western machines.

3. There is strong interest in obtaining Western IC testers, particularly automatic systems.

4. IC testers are being built by the manufacturer of IC's rather than by specialized producers. Moreover, they are not believed serially produced anywhere, and known attempts to design and build IC testers in series have resulted in failure. For example, the Hungarians recently built three or four test systems, designed specifically for IC production lines, and none operated successfully.

Table 1

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Estimated Production of Semiconductors in the USSR and Eastern Europe, 1972

(Millions of Units)

	Diodes	Transistors	Total Discrete*	Hybrid	Monolithic	Total ICs *
USSR	640	483	1123	40	45	85
Bulgaria	--	--	39.8	--	--	0.2
Czechoslovakia	--	--	74.0	--	--	2.0
East Germany	--	--	175.0	--	--	1.0
Hungary	--	--	45.0	--	--	1.0
Poland	--	--	38.5	--	--	0.5
Rumania	--	--	31.6	--	--	0.4
East Europe	--	--	403.9	--	--	5.1
USSR & East Europe	--	--	1526.9	--	--	90.1

* Does not reflect rejects by end-users, which are believed to be substantial.

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